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A study of bus transportation was conducted by the Department of Business at Central Michigan University to determine the feasibility of centralizing the transportation function of the seven rural schools in the COOR Intermediate School District in Michigan, who, at the time of the study, operated their own transportation systems. Investigation was made of the feasibility of combining the following areas: (1) bus purchasing; (2) routing and scheduling; (3) bus maintenance; and (4) overall transportation administration. Conclusions reached in the study indicate that combining these operations would result in a more efficient and economical bus operation for the seven local school districts involved. (RH)

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FEASIBILITY OF A CENTRALIZED TRANSPORTATION SYSTEM IN A RURAL INTERMEDIATE SCHOOL DISTRICT

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FORWARD

This analysis has been conducted by The Research Fellows of the Department of Business at Central Michigan University. This study of Bus Transportation was financed through a Title V grant-in-aid. The study was done by Mr. William F. Boose and Mr. John W. Cleverdon under the direction of Dr. Norman H. Deunk, Chairman of the Department of Business at Central. Supervision at the local level has been coordinated by Mr. John Gretzinger, the Director of Federal Projects for the COOR Intermediate School District.

The purpose of the study was to determine the feasibility of centrally coordinating and directing the present transportation function of the seven school intermediate district. At the time of the study, each school district operated its own transportation system.

The study investigates the feasibility of combining these systems. These four basic areas received primary concern: 1) the bus purchasing procedure and criteria, 2) routing and scheduling of the busing operations, 3) proper and economical bus maintenance, and 4) the overall transportation administration in the district.

The data presented in this study has been compiled and analysed by The Research Fellows. It is intended that the results be available to COOR Intermediate School District and districts or individuals interested in school bus transportation.

William F. Boose

John W. Cleverdon

We acknowledge the cooperation of the following persons who have aided in the completion of the study:

THE COOR INTERMEDIATE OFFICE

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SUMMARY OF FINDINGS AND RECOMMENDATIONS

The COOR Intermediate School District can make an important contribution to the school bus transportation operations of its member districts. The results of this investigation indicate that it is feasible to centralize the transportation function through the COOR office. These conclusions and recommendations are detailed below. It is felt that the implementation of these recommendations will increase the overall effectiveness of the transportation operations of the COOR member districts.

I Purchasing:

It is recommended that bus bodies be bid for and purchased cooperatively, with the administrative details handled through the COOR office. This will call for the formation of a district-wide committee to develop specifications that will be acceptable to all involved. With all points of view incorporated into the specifications, the member districts will be getting the best possible bus body from a safety as well as a utility standpoint.

Cost savings may not be realized immediately, but will be evidenced over a period of time. The local districts will also experience a valuable administrative time savings, since one-half of the transportation purchasing function will now be handled through COOR.

It is also recommended that in the future the local districts consider using the life cycle buying concept in the evaluation of bus chassis bids. This will require the anticipation of future expenses, so that the total cost of the vehicle over its lifetime can be determined. The information needed to determine costs over lifetime can

be made available through an intermediate district-wide maintenance reporting system. A system of this nature has been recommended and will be detailed later.

II Routing:

The routing function is being performed adequately by the local districts. However, this does not mean that improvements cannot be made. It is recommended that one of the local districts, with the aid of the COOR office, investigate the possibilities of routing with electronic data processing.

The data processing systems used in school bus routing are readily available and reasonable in cost. A number of school districts, both rural and urban, are routing with EDP and find that the advantages to be gained in time savings are sizeable. The local transportation supervisors in the COOR Intermediate district should welcome any technique that can save time and increase the effectiveness of their operations.

III Maintenance:

From a district-wide cost standpoint, the maintenance operations are adequate, but not optimum. Although the maintenance operations are not uniform in performance, they share a common problem, insufficient historical fleet data. This information should be available and used if optimal decisions are to be made concerning bus fleet operation.

It is recommended that an intermediate district-wide maintenance reporting system be established with EDP and administered through the COOR office. This information reporting system can provide in-depth

reports concerning fuel/oil consumption, repairs made, labor used, and parts needed. This valuable information will be summarized by bus and by fleet for each month of operation, with accumulated costs year to date. At the end of the year, these total costs by category will be available to combine with the other known transportation costs, thus reflecting the total cost of the operation.

The availability of the management reports generated by this system can aid substantially in making the local transportation operations more effective. The information made available will facilitate the development of life cycle buying as well as aid in the development of accurate preventive maintenance schedules.

IV Administration:

It is recommended that the COOR office should function as the administrative service unit for the member districts in the general areas of purchasing, routing, and maintenance reporting. It is clear that the COOR office can coordinate these programs using available data processing techniques. These services should be performed in close cooperation with the representatives of the member districts.

The COOR staff presently has available the capacity and expertise that is required for this service. It is recommended that the COOR staff be made responsible for implementing these recommended programs.

It is also recommended that the COOR office function as a clearing house for the dissemination of information about bus transportation to the member districts.

BUS PURCHASING PROCEDURE AND CRITERIA

INTRODUCTION

At the present time, all buses are purchased separately by each of the seven school districts. Each district has its own purchasing criteria. In each case, separate body and chassis specifications are established and bid upon, with the lowest bid being chosen in each instance. In all but one district, the bidding was open only to new vehicles.

In the 1967-68 school year, $87,500 was spent for the replacement of buses throughout the intermediate district. This represented 24.54% of the total transportation operating expense.

The purchasing of buses is not an area of transportation that can be undertaken lightly. As is evident from the percentage of the transportation dollar spent for the replacement of buses, the proper procedures and criteria are of vast importance to any school district.

Continuing changes in many districts from year to year, movement of population, regularly overtaxed budgets, and an increasing variety of equipment from which to choose all make the purchasing of buses more of a problem each year. It is for these reasons that the purchasing function must be evaluated carefully before specific recommendations are made.

In attempting a detailed analysis of the purchasing function, all pertinent aspects of each school district were reviewed and individually analysed for improvement. Comparisons were then undertaken to discover the similarities and differences found in the intermediate district as a whole. The dimensions to be covered will include both

research and recommendations for COOR to consider for future investigation and possible application.

PRIVATE VS. PUBLIC OWNERSHIP

One of the first dimensions researched was the possibility of eliminating the bus purchasing function altogether. In other words, the possibility of contracted services to handle the transportation function of the individual schools. As all school administrators are aware, certain districts in some states are successfully using contracted services for transporting their children.

In the early years, nearly all school transportation vehicles were privately owned. Today it is conservatively estimated that over 80% of the school buses on the road are publically owned. The greatest advantage, especially in the early years, of contracting such services was that the schools were able to avoid purchasing and maintaining buses as well as the administrative details necessary in transporting the children. Today, the transportation function has grown so large and become such an important aspect of the over-all school operation, that it is no longer as feasible and economical for as many districts to contract such services. The reasons for the nationwide trend of public ownership of buses rather than contracted services are numerous. A few of the more important are as follows:

1. The big factor is one of economy, In a public ownership system, there is no profit motive as there is in contracted services. At the same time, the school district may be exempt from certain taxes and in most areas, can obtain gas, oil, licenses, etc. at a cheaper rate.

2. With the many new courses available in most schools today, such as special programs for handicapped children, supplementary programs (field trips, outdoor education, and numerous special visits) and other such endeavors, the transportation of children is made a much more integral part of the school program. Thus, it is clear that schools need the closer control that comes with public ownership. Other advantages include flexible scheduling, control of the behavior of children on buses, control of employment of capable and safe drivers, and for actual instructional activities while buses are on route.[1]

3. Another important advantage of public ownership is the factor of safety for the transported children. More personal care is taken in the selection of vehicles, selection of drivers, and the overall supervision of the transporting of children. Safety alone could be the deciding factor for a move in the direction of public ownership and away from the use of contracted services.

It should be clear that the feasibility of using contracted services in the COOR Intermediate District is non-existent. The advantage of relinquishing the function of purchasing is completely overruled by the disadvantages of the contracted system

COOPERATIVE PURCHASING ARRANGEMENT

An area which would seem to have great potential in application to COOR's present operations deals with the purchasing of buses on a cooperative basis by the intermediate district.

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[1]"The School Bus--Public School Servant or Private Profit Maker," Maryland State Department of Education.

As was previously indicated, at the present time all individual districts are responsible for their own bidding and negotiations. In considering the above alternative, it is necessary to analyse the specific purchasing systems in operation at this time. Effective comparison requires that information be available to indicate exactly what each district requires in their individual specifications. Since each district has its own specifications and bidding procedures, it is quite difficult to list all similarities and differences uncovered by the comparisons. Except for minor differences in detailed specifications, the following dissimilarities arise:

a) Engine horse power and cubic inch displacement

b) Power vs manual steering

c) Size of gas tank

d) Ignition design

e) Radiator specifications

f) Specific bus capacity

g) Windshield contruction

One may conclude that the major differences found in specifications are in the area of chassis choice. While there were other minor dissimilarities found in both types of specifications among the seven school districts, they were not varied enough to rule out a common purchasing approach.

The following questions had to be answered to determine if a single purchasing body (COOR) was feasible.

Could centralized purchasing (through COOR) actually save the individual school districts any sizeable amount of money?

Are the specifications too dissimilar to even consider such a move practical?

Would the individual school districts agree to such a system of bus purchasing?

How would such a system be coordinated and implemented?

How would the buying criteria and procedure be determined?

Would this system actually be any more beneficial or economical for the individual school districts and COOR as a whole?

The first step in answering the above questions was to review the purchasing activities of other districts. Through investigation of the purchasing area, it was found that at the present time only a small number of Michigan schools followed such a plan. The forerunner in this area is the Oakland School District in Pontiac, Michigan.[2]

Upon researching further, it was determined that up to this date the most successful centralized purchasing procedure in Michigan was in the area of body specifications. In some attempts centralized purchasing of chassis were only partially successful. (This lack of success is attributed to the personal preferences of each school district to specific chassis manufacturers and the local chassis dealers bidding in the areas surrounding the schools.) For this reason, our analysis will begin with the purchasing procedure dealing with body specifications only.

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[2]Our gratitude is extended to Mr. Erwin Hendershott, Oakland School District of Pontiac, Michigan, who has been most helpful in providing us information in this cooperative purchasing alternative.

The recommended purchasing approach is a composite of the present systems in operation. It is the philosophy of those presently using this system that when several school districts get together and pool ideas, everyone will be benefited with an all-around safer and better body for their buses. Joint decisions can be better decisions if the groups pool their resources.

The actual process of setting specifications is somewhat similar to what is presently undertaken by the seven school districts in COOR, with the addition of an improvement in coordination and pooling of group effort. Standard specifications are agreed upon by all representatives of the buying committee (one representative from each district is needed in initial specification determination). From there, a list of optional specifications are established from which individuals could request to be included on their buses. The reasons for the optional specifications are quite evident. In one instance road surfaces might make the difference for particular buses; in another, possible varied uses of a particular vehicle (transporting of handicapped children, etc.) may call for certain optional equipment not found or needed on other buses.

In determining such multiple specifications, the establishing of one set of specifications to be used by all school districts is eliminated. With such flexibility present in the system, the specific needs of individual school districts could be met.

By using this new system of establishing coordination, the intermediate office will have a listing of both the standard and optional equipment in their files. At the point the individual school district

is requested to make their choice of body for their buses and the order is complete. A model bus body bid with explanation can be found in Table I of the Appendix.

It was determined that because of the varied chassis preferences of the individual school districts, the local dealer pressure in each area, the local servicing policy present, and the other individual discrepencies found in each area, such a detailed policy for chassis bidding would not be feasible. It was the estimation of an expert in the area of cooperative purchasing that no foothold can be gained in chassis buying until cooperation is handled directly through the home office of the manufacturers. Until these manufacturers can establish cooperative bidding between their dealers in each local areas of the schools, nothing satisfactory can be established.[3]

What does this analysis do to the central purchasing plan for COOR? There is no reason why cooperative bus body purchasing could not work out satisfactorily with the cooperation of all seven districts. Before specific recommendations are to be made it is especially important to note that complete cooperation is needed by all. If the plan to be presented is to be successful all must agree to it and accept it wholeheartedly.

The most efficient and beneficial means of establishing such a system would be to form a committee for the purpose of establishing the exact criteria and procedure for cooperative bidding. It is important that each district involved has a chance to express and contribute his views to the overall establishment of the system.

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[3] IBID. Mr. Erwin Hendershott

This committee should be comprised of a representative from the COOR Intermediate Office who would be the coordinator and a representative from each of the individual school districts. The district representatives should be the men presently responsible for this purchasing function within their district. The district representative would be the superintendent, or a delegate designated by the superintendent.

With the establishment of such a combined committee, the experience and knowledge of all representatives would be brought together, resulting in more satisfactory specification determination. When all of the districts put their heads together for this initial move, each could offer his own techniques and experience of the past.

Once these specifications are determined and thoroughly agreed upon, a cooperative bus body bid sheet could be developed for the COOR Intermediate District. It would be somewhat similar to that as presented in Table I. The individual schools could merely send their order into the COOR office and allow the intermediate office to handle all the bidding details from that point forward in the purchasing activity.

The major advantages of such a proposed system are that each of the individual schools would be benefiting by receiving a better planned, safer, and more important, a wiser choice of body. After the committee has once decided upon the specifications needed, (both standard and optional), all of the administrative details of sending out bids and deciding on the choice of bid, etc. would be handled by the COOR office. Much time and effort presently undertaken at

the local level could be lessened, if not avoided completely. Another advantage which should be a definite cost savings is that the system will enable COOR to make a more detailed analysis of all the important factors in bus purchasing. Possibly one or two districts are overspending by ordering specifications that are not necessary or perhaps a district is underspending on certain specifications which are costing them more money in the long run in repairs and maintenance.

An important consideration not yet mentioned is the area of cost savings as a result of larger scale purchasing. The amount of savings that would actually be realized is hard to determine. Possibly, at the initial onset of this system, a district might be finding itself paying a few extra dollars for their body. What it might not realize is that they are now getting more for their dollar. From the administrative aspect alone, efforts on the local level will be lessened considerably.

How much more advantageous is it for COOR to purchase sixteen bodies than for an individual school district to purchase two or three? Upon researching this question it was found that there is no one predetermined number to which a body manufacturer looks at for quantity discounts. However, the proposed system will benefit the districts by better defining specifications, reducing the administrative details at the local level, and increasing the cooperation needed in the burdensome area of bus purchasing. Along with these benefits listed above, each district will continue to receive the individualized or personalized bus needed for each purpose. Thus the obvious disadvantage of this system, one-set of bus body specifications mandatory to

all districts will be eliminated. With a system such as this, there is no reason why such a plan will not work for COOR.

With the planned and detailed coordination coming from the COOR office, it will enable the individual districts more time to spend on the efforts needed to combat local problems not as effectively handled through the central office.

It is also suggested that some form of the above procedure be handled in cooperation with two or three intermediate districts. It possibly could even be handled on a state-wide basis. The largest drawback to this suggestion is that there are many different options needed by individual districts. Optional equipment could make up the majority of the specifications and therefore only complicate matters more. It is a possible approach that could have some real application in the future. It is definitely an area in which the State Transportation Department should be investigating.

It is interesting to note that, at the present time, there is in existence a state-wide cooperative purchasing program being carried on by the State of Kentucky. More specifically, it is a state-wide agreement on both the body and chassis specifications. Each year the state purchases all buses on one negotiated bid resulting in the total purchase of from 1500 to 2000 units in one order.

According to a State Transportation Representative from Kentucky the system has not only been operationally feasible, but also quite economical for the individual districts. It was estimated that the buses being purchased for the years 1969-70 will cost $1600 less per

unit than the same bus purchased individually by school districts in other states.[4]

Because of the success of this state-wide application of cost savings in school transportation, we wholeheartedly recommend that such a program be investigated by the Michigan State Department of Pupil Transportation. It seems quite unfortunate to allow years to pass without specific investigation into these dimensions of school cost reduction.

LIFE-CYCLE BUYING CONCEPT

The final dimension incorporated into the area of bus purchasing is somewhat two-fold. It was questioned whether accepting the lowest bid and purchasing new rather than used busses was always the best practice.

In considering the lowest bid concept, the investigation turned to a new approach used in current government purchasing procedures, life-cycle buying. This new approach focuses on the total cost of owning an item throughout its life, rather than just its original cost. Possibly the busses that the individual school districts are now purchasing on the lowest bid concept are costing them more money over the life of the vehicle than another higher bid bus.

How would a district go about installing such an approach? Initially it would require different bidding procedures. The body and chassis manufacturers would be required to submit a detailed bid including not just the bid price for the vehicle at the present time

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[4]Our appreciation is extended to Mr. Paul Jones, State of Kentucky, School Transportation Office, for his assistance in this area.

but also include such variables as expected operating and maintenance costs over the life of the bus, replacement parts over this determined time period, etc.

The bus selected will be the one with the lowest expected lifetime cost; not the lowest original purchase price. This approach would bring a new dimension to traditional negotiated buying of the low-bid practice.

A point of concern is that of convincing the manufacturers who might be unwilling to make such a detailed bid. They may argue that the future life of a bus is too unpredictable. Road surface changes, driver differences, servicing differences, and many others could be obstacles presented by the manufacturers. The above reasons could be definite stalemates to the application of the suggested alternative.

If the above expressed approach would not be applicable from the standpoint of manufacturer participation, it is suggested that COOR or the individual districts initiate a study of their own to actually determine how much the individual buses are costing them over the expected life of each. If proper records are maintained, each district could make such a detailed study. (More depth into this area of future application of proper maintenance records will be covered later in the report.)

At this time it is recommended that the latter modified version of the government's life-cycle buying concept be investigated for further application. This approach would have the special advantage of allowing more local variables to be intertwined into the analysis. Local servicing information, driver effects, proper maintenance

reporting, and other important factors could be more satisfactorily applied at the local level.

The definite advantages of such an approach will eventually result in cost savings to the districts. The point to be made is that possibly the lowest bid at the time of buying a bus is not always the lowest total cost over the expected life of the vehicle. If proper handling of this area is investigated at this time, the savings could be vast over a period of years.

The remaining investigation involving the analysis of new versus used bus purchasing will be taken up later in the study. It is mentioned at this time to indicate that it has been considered as an area of purchasing which may yield a possible cost savings to the individual districts.

BUS SCHEDULING AND ROUTING

INTRODUCTION

The details of school bus routing have plagued the lives of many a school administrator for years. For an effective and efficient school bus program to be established, routing seems to be the heart of all beginning efforts. The routes must be laid out to provide maximum benefits for children, parents, teachers, principals, and other school officials.

To a layman, the process sounds fairly simple--"Run a bus down the road and pick up my children". As all school administrators know, transportation routing can be, and is in many cases, one of the largest problems to be faced each year. For this reason, this area has been given detailed and individualistic attention.

The initial step was to locate the abundant number of articles published in school administrative journals and periodicals. The exact number of published materials located was almost unlimited. Since this topic is of such importance and since there are so many individual school district problems evidenced by each, the research proved to be invaluable in assessing just what improvements would be feasible for the COOR Intermediate District.

After an intensive investigation of the secondary research information available, an analysis of the present routing systems under operation in the seven districts within COOR was undertaken. It was the purpose of this analysis to uncover who was responsible for the primary transportation decisions within each district, exactly how each element was handled, and finally to uncover areas in need of improvement in the future.

Data processing applications to school bus routing was considered an alternative worth investigating. On April 24 through 26, a Data Processing Application to School Transportation Seminar was held at Eastern Michigan University in Ypsilanti, Michigan. All interested persons and experienced prioneers in the area of data processing applications and school bus transportation from around the nation were present. The knowledge gained at this seminar proved very fruitful, and the assistance of all present who aided in the analysis in this report are greatly appreciated.

It is felt that COOR will definitely benefit from the results and recommendations to be provided below. Research and correspondence with experts in this vital area of routing has opened future doors for intermediate districts such as COOR to lessen the detailed administrative problems and widen the possibility of applying various time-saving elements to their present systems.

CURRENT ROUTING TECHNIQUES IN OPERATION

Practically all current data pertaining to present and future routing systems eventually move toward one basic topic--manual versus data processing determination of routes. Since all presently performed routing and scheduling within COOR is accomplished through manual operations, ideas in this area will be expressed first.

The basic tools needed for this laborious approach to manual routing include a large scale area map, a clearly laid down Board policy on pupil transportation, and the objective of preparing the most direct routes in order to make the time spent on the buses by the children as reasonable as possible.

Present routing systems used in the COOR district for route preparation studies ranged from detailed cooperative scheduling by bus supervisors and individual drivers to one-man route preparation operations using only past knowledge updated with present drops or increases in enrollments.

The most significant factor discovered in analysing the seven districts within COOR was the fact that too much of the administrative details of busing landed in the hands of the local superintendents. In order to alleviate this overburdening of the local administrators, the alternative would be to centralize the function through the intermediate office.

If the intermediate office could take over the major functions of routing, it would allow the local school personnel to concentrate their efforts on the other duties not as operationally feasible from a central office. If the COOR office is to provide this service, it is quite evident that the present routing procedures are in need of change. What is this change? All indications would point toward data processing applications. It is important to note that this is a definite area for future application by the COOR Intermediate School District. It has been estimated by one district alone that it expects to save the price of two or three buses in the next year through the use of data processing for route preparation.

It cannot be denied that data processing is definitely the future "answer" to most routing problems found in school transportation programs of today. How does a school district go about setting up such a system? What is the initial cost? Is it applicable to a rural area

area such as that faced by the schools in COOR? These and other questions will be investigated and answered in the analysis to follow.

IMPLEMENTATION OF DATA PROCESSING

While it was previously mentioned that there are schools around the nation being presently routed through the use of data processing, this whole area of application is in the pioneering stages of development. Some of the leaders of such working programs are Hamilton County School System in Ohio, Toms River Schools in New Jersey, Dade County Schools in Florida, Robbinsdale School District in Minnesota, and San Bernardino City Schools in California. This is by no means a complete list, but they are the primary sources of information gathered for the study. The above list provides a good cross-section of the programs available for operation. Specific contributions will be enumerated in the analysis to come.

It is extremely difficult to set down one procedure to follow in attempting to incorporate data processing into bus routing and scheduling, but with the aid of the schools mentioned above the following composite system was developed. The program to be presented below was prepared on a somewhat basic level, omitting confusing EDP jargon as much as possible. It is intended not to specifically establish a detailed program for approval at this time but basically as an aid in summarizing the approaches in operation and in return presenting future advancements planned through EDP applications. Throughout the explanation, the necessary information for the program and their sources will be specifically identified.

The composite plan is as follows:

1. General Determination and Recording of Student Information. A master card with all pertinent information must be established for each student. Data necessary for such a file includes student name, (in some cases also a designated student number), home address, school number (previously designated), sex, grade (or sometimes more practical, year of graduation), and with some programs, nearest intersection to home. From here, all above information is punched on student master cards and placed in a student address file. The student addresses are properly coded according to direction of streets, street names, house numbers, and other specific identifications.

By previous eligibility determination by the district, a street eligibility file is developed. This is a file by school with the beginning and ending addresses of each street or road within the school's boundaries--those addresses that are eligible for bus transportation. Various processes are used in measuring and determining such eligibility locations, some of what COOR is using at the present time in their manual operations, so there is no need to go into more detail at this point.

One significant factor to note here is the necessity for a workable system of obtaining the proper information for the above-mentioned files. The system depends heavily upon the accuracy of information used to determine proper filing. One system in operation today could have some significance at this point. Mr. Robert Larsen, Supervisor of Pupil Transportation and Census in Robbinsdale, Minnesota has successfully combined his two areas of work into a program in

which the computer tabulates the data for Robbinsdale's 40,271 children on his census lists and directly uses these in routing and scheduling the district's 68 buses.[5]

It is quite a unique setup because it utilizes the same information for both purposes. It eliminates the majority of the inaccuracies present with the use of student information sheets completed by the individual students. (This is an especially interesting note with Michigan's new legislation releasing mandatory census taking. COOR should take a good look at the capabilities of such a system before finalizing their census decisions.)

2. Eligible Student Identification for Route Determination.

With the files mentioned above, students eligible for bus transportation and their specific locations are drawn from the collection of data. In other words, a matching process occurs, utilizing the student address file and the street eligibility file.

According to one system used in Toms River, New Jersey (which is utilizing the IBM Vehicle Scheduling Program) districts are broken down into zones. From there, individual bus stops are determined within each zone by the computer. Student master cards are then punched with the appropriate zones and individual stops.[6]

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[5] Our gratitude is extended to Mr. Larsen, Supervisor of Pupil Transportation and Census in Robbinsdale, Minnesota, who has provided us with the useful information concerning the application of a combined census-routing system.

[6] The above information has been gratefully supplied by Mr. Melvin J. Thompson, Transportation Supervisor, Toms River, New Jersey

With the use of a different method, eligible students are located and properly and accurately plotted on maps. At this point, suitable routes and stops are determined by the computer. After plotting operations have been completed, summary cards (already previously determined by street name, block, street number, direction, and number of students) are used for assigning students to particular stops. (As is quite evident, the above approaches are primarily concerned with urban areas. If COOR used such a system, most stops would be predetermined by house stops.)

3. Proper Report Provisions and Procedures for Changes in Eligible Pupils are Determined. It is especially necessary under such a system that proper reports regarding route assignments are adhered to. Through the use of the information of the eligibility file and the route assignment file almost any kind of reporting desirable can be obtained with very little effort. Just a few of the reports that can be generated are transportation route listings, mail stuffers, listings of bus stops by street or road addresses, or other numerous helpful summaries used throughout the school year. The advantage is having these reports at your fingertips whenever needed just by matching appropriate files.

Another element of the system is a proper procedure for processing new students moving into eligible locations and present students moving from the area. Each change must be added or depleted from the files. Appropriate forms are usually developed to handle such a process.

The plan presented above is somewhat simplified in nature, but it does fulfill the intentions of explaining the necessary procedures

and information to establish such a computerized system. It should also be noted that once this initial data is gathered and filed with the computer, the following year's route determination is minimized to a significant degree. This is assuming that there is a fairly regular transition from one year to the next. In June, the present files could be updated by means of dropping pupils graduating or otherwise leaving the schools, and adding students new to elementary, junior high, and senior high. From there, the same process of matching files as mentioned above would be followed. Minor adjustments would later be made for needed pupil adjustments.

The implementation of a data processing system for routing is not an easy task. If such a program was implemented, better information gathering and presentation would be needed. More accurate maps and stops would have to be developed. And most of all, the various human factors being affected by such computer implementation at both the local and the intermediate levels would be significant.

RECOMMENDATIONS TO COOR

After analysing all factors related to COOR's operations in the area of routing, and after investigating possible implementation programs for data processing application, it is recommended that the intermediate office take definite steps toward computerization of the function.

The first reactions of the individual districts might be quite apprehensive. This was the feelings of the authors at the outset of the study. It took much research time and convincing selling before this decision was finalized. With the aid of all the needed

information and techniques at the intermediate's finger tips, it is definitely quite feasible for such a move in the near future.

There is little doubt that such a system would work in a rural area. It would not be much different than an urban area except for the apparent increase in the individual number of stops. But would such a system benefit COOR since the stops and actual routing will be approximately unchanged?

First of all, the burdensome details of manual routing will be eliminated. Secondly, the more important, in the long-run permanent files will be computerized at the intermediate office for the many varied applications explained above. And thirdly, more efficient and standardized routing will be developed resulting in possible cost savings to the individual schools.

Another question destined to be raised is why a small district such as found in COOR would want to move to such a system when it can be handled by hand? "Sure it is a laborious process, but the system is working for us now." One important factor answers this question--the total systems approach. The total systems approach integrates all elements of the transportation function and coordinates them as a more efficient operation.

Once a program is established for one area, such as routing, other sub-products can evolve. Such elements as the previously mentioned maintenance reporting system, inventory control, etc. are a few of the examples. At the same time, other EDP applications of the districts' administrative details of grade reporting, class scheduling, etc. can be part of this system. In other words, routing

will only be a segment of the entire application planned for the future.

What about the cost? It was estimated that at the initial start of such a system the cost would be approximately $2 to $3 per student transported. It must be remembered that also considered in this cost will be the other benefits derived from the above mentioned total systems approach. The cost will be spread out over the varied applications derived from the computerization of the function. It must also be made clear that it will take a few years for this system to start paying back dividends through its use in coordinating the life-cycle buying concept, proper maintenance reporting and resulting cost savings, etc. It should be looked at as more of an investment at this time rather than as a cost.

It has been suggested by pioneers in computerized routing that such a move should be slow and deliberate. The ideas as one expert put it, "Don't move into data processing for the sake of being able to say you are using data processing." Such a move could be disastrous. At the same time, districts should not be afraid of such a step. The benefits over the years of the investments can prove invaluable.

Taking this advice, it is recommended that a step-by-step process be used. It is suggested that COOR experiment with one district, instead of all seven. There is no way possible of eliminating errors in any program, but there is a way of limiting the magnitude of such errors. It is also recommended that the district chosen by one of average or above average size, one with a variety of both successful and problematic dimensions, and most of all, a district which is

willing to accept such a feasible system and agree to spend the necessary time and effort to coordinate such a program.

It is recommended that a selected district within COOR take advantage of an excellent opportunity to make the move this summer. Through the efforts of the previously mentioned Data Processing Seminar held in Ypsilanti in April, a July Workshop has been established for interested beginners. The workshop will continue for a full week with technical direction from leaders in the field of EDP applications and program developers.

COOR will be able to provide the selected district with the necessary means of proper data collection, specific details concerning the workshop, and the necessary arrangements for taking an active part in the program. All that is left at this time is the determination of the specific districts to cooperate with the recommendation.

It is up to COOR to make the choice on either a voluntary or suggested participant. The intermediate district office has already volunteered its' services to aid the local district in it's coordination of the program.

It is the recommendation of this study that a representative from both the local and the intermediate office coordinate their efforts in planning and executing such a program. Since it is the ultimate projection that the COOR office will sometime in the future be coordinating the function by a centralized office, it is definitely necessary that it works every step of the way in any developmental stages. At the same time, it is a necessity that the local districts participate in such a program. They will ultimately benefit from

the results only if they are properly acquainted and in full support of the program.

The purpose of the workshop is twofold. The first being that of furthering the feasibility of computerizing school bus routing systems as a whole. Much time and effort has been undertaken to make this opportunity available. The workshop is under the direction of Mr. Homer Earl, Director of Continuing Education, based at Western Michigan University. The technical aspect of the operations will be under the direction of Mr. Tony Ross, Director of Data Processing at the University of Mississippi[7].

Secondly, the workshop is intended to be an invaluable aid to the various districts around the nation investigating this area of computerized routing. It is truly an opportunity for a district such as COOR to "get their feet wet" and actually gain some working knowledge to determine the operational feasibility of the projected coordination for the entire intermediate district.

The information needed to participate is as follows:

1. A map clearly marked with the present stops used in the manual system.

2. The times between each stop (possibly the distance also).

3. A limited number of alternative moves between stops.

In order for the workshop to benefit the district, there must be some means of comparison to operate with. By checking a limited number of alternatives against the present route, the computer program

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7. Mr. Ross is one of the experts in the nation in this area of computerized routing. It was with his technical assistance that the R. A. Boyer Computer Application Study of EDP was aided in its completion.

will compare and choose the best route formation.[8] Possibly the manual determination is at its' maximum point of efficiency and the computer could only confirm this point.

The question may be asked, Why should we go through with this exercise when we have to manually determine routes anyway? The answer to this is that the workshop will acquaint you with the computer process generally, and applications to your district specifically. It would be looked at as a step in the right direction. Someone has to make the initial breakthrough.

In following the above program, it is felt that COOR will be advancing as one of the more progressive districts in the State of Michigan in this area of data processing applications. With the recent purchase of the hardware to be installed in the near future, and with the availability of the needed software to get such a system underway, it would seem quite unfortunate if the above recommendations were not followed.

The emphasis of such a decision must be directed from the intermediate office. The purpose of such an office is to serve the individual districts in their administrative and operative details. What better service could be provided than one such as the total systems

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[8]By a limited number of alternatives, it is meant that although we presently move from stop 1 to stop 2 to stop 3, etc., possibly an alternative would be to move from stop 1 to stop 4 or from stop 1 to stop 3 etc. With these alternatives, the computer can make the choice between the present stop sequence and the alternatives listed. In some cases, there may be only one sequence to use, others there may be three or four logical sequences to move through. It is also suggested that this be accomplished with at least five individual routes. Too many in excess of five will only overburden the objective of the program.

approach which could be offered at this time? The overall time and cost savings over the years to come could be quite sizeable if all local districts cooperate and plan accordingly for the future.

PROPER AND ECONOMICAL BUS MAINTENANCE

INTRODUCTION

It is one of the objectives of this study to determine if there would be any advantage in centralizing any or all of the maintenance activities through the COOR District. To make any valid judgments about centralized maintenance, the present maintenance operations will have to be investigated.

During the school year of 1967-68 the maintenance expense for the COOR Intermediate District was $78,356. This represented 22% of the total transportation expenditure for that year of the seven districts comprising COOR. Four of the districts operate their own maintenance stops, while the remaining three use local service garages. As can be observed in Table 2, the effectiveness of the maintenance operations, relative to dollars spent and miles driven is varied. It is quite difficult to draw any meaningful conclusions from these figures because local conditions vary greatly with respect to road surfaces, age of fleet and management techniques employed. From what could be determined, the maintenance operations of the local districts are not operating at top efficiency, primarily because they do not maintain adequate historical records. The absence of these records is resulting in a loss of a very valuable management tool, which aids in the efficient operation of a bus fleet. More will be said about solutions to this problem later in the report.

TABLE II

MAINTENANCE EXPENSE - COOR INTERMEDIATE SCHOOL DISTRICT
1967-1968 School Year

School District	Cost	Miles Traveled	Cost Per Mile
Mio-Ausable*	$ 9,305	94,850	9.8¢
Gerrish Higgins*	14,325	124,230	11.6
Houghton Lake*	17,756	216,633	8.0
Crawford Ausable*	11,404	122,151	9.2
West Branch**	28,656	306,448	9.0
Fairview**	5,774	69,825	8.2
Richfield**	1,136	24,580	4.6
TOTAL	$78,356	859,117	7.2 Average

**Districts that use private garages

*Districts that operate their own garage

Source: COOR Intermediate School District

DISTRICT OWNED VERSUS COMMERCIAL SHOP

To determine the feasibility of a COOR operated centralized shop, first one must consider the alternative of using privately owned shops.

It has long been recognized that in most every situation given adequate fleet size (10-14 minimum), that the district owned shop is the best way to efficiently maintain a school bus fleet. The advantages of a district owned shop fall into four major catagories:

1. Safety
2. Economy
3. Control
4. Availability

Safety is the most important consideration in maintaining a bus fleet. It cannot be assured unless an effective preventive maintenance program is practiced. The district owned shop best allows the implementation of a preventive maintenance program because of the control and availability of materials and personnel.

Economy is an obvious advantage of the district owned shop. In most cases, this approach results in a sizable reduction in money spent for repair parts and labor. The district owned shop also allows for greater control of the transportation budget.

It should be of no surprise to the members of COOR that the district owned shop is the most advantageous. Those of COOR who do not operate their own shop recognize that they could do a better job if they did own their shops. At this time they can not move in that direction because of financial handicaps.

Since most agree that owning the shop is the best alternative, how does the centralized shop fit into the picture?

CENTRALLY OPERATED SHOP VERSUS DISTRICT OPERATED SHOP

To make the centralized shop idea feasible, the local district would have to be:

1. Operating in a grossly inefficient manner
2. Close enough geographically so that proper administration would be possible.
3. Close enough geographically so that the time traveled to and from the shop would not be prohibitive.

From the information gathered and analyzed, it is evident that although the local shops are not operating at optimum efficiency, they are performing a credible job. There is certainly nothing that could be done better in a centralized shop that could not be done better in the local shop. The local shop offers the important features of control and availability which would be lost in a centralized shop because of the geography of the COOR district.

Theoretically, a centralized shop could offer economy through bulk purchasing of parts inventory, gas and oil, but because of the wide geographic dispersion of the member districts, it becomes clear that, from management standpoint, the centralized shop is not a viable alternative.

If any recommendations should be made concerning the type of shops operated, they are obvious. It is clear that West Branch and Fairview should move in the direction of shop ownership. The situation in Richfield is not as critical, because at the present time their fleet (2 buses) is relatively new and

maintenance costs are not high in relation to the miles driven. They still are forfeiting the advantages of shop ownership, which in many cases can be justified on safety considerations alone. Perhaps in the future they will be absorbed into the Gerrish-Hgggins or Houghton Lake District. Both of these districts presently operate their own shops and Richfield could gain the advantages of shop ownership if they were absorbed into either of them. However, at this time shop ownership cannot be recommended simply because their fleet size makes it prohibitive from a cost standpoint.

THE NEED FOR INFORMATION

It was mentioned earlier in the report that the member districts of COOR do not have enough historical fleet data from which to make decisions. It was difficult to make a meaningful analysis of the vehicles purchased by the districts, simply because the information was not available. There are no figures available from COOR that prove the district-owned shop is better than a private shop. These conclusions were drawn exclusively from secondary research, in which a before and after analysis was made with reliable and complete information. This should illustrate the point that if one is to make the right management decisions, complete and reliable information has to be used.

The area of information retrieval is one which COOR can become deeply involved in. As was stated above, in the course of conducting this study the need for an intermediate district wide maintenance reporting system has become apparent.

Every transportation supervisor should have at his fingertips information concerning:

1. Repairs
2. Labor
3. Parts
4. Gas/Oil
5. Other miscellaneous expenses

Armed with this information by bus and by fleet on a monthly and year-to-date basis, the transportation supervisor can quickly and accurately spot specific maintenance problems.

This information has direct application to the implementation of preventive maintenance and life cycle buying analysis.

PROJECT TRI-TRAN

The kind of information system we are recommending for COOR has already been developed in a project funded by a Title III grant, undertaken in Hamilton County, Ohio.

The basic goal of this project, named TRI-TRAN is to develop an integrated information system for maintaining a school bus fleet. With the help of data processing,a program has been developed that will provide local transportation supervisors with tools that will aid them in the analysis of their maintenance operations.

The description of the program to follow has been borrowed freely from the TRI-TRAN progress report. We are deeply indebted to Mr. Robert Tanner, project director, for giving us the added insight needed to solve the information gap problem in COOR

MAINTENANCE REPORTING--AN INFORMATION SYSTEM

The tools that are needed to implement the maintenance reporting system consist of four worksheets and a work code list

which is very flexible, depending on the needs present. These forms include (See Exhibit ABCDE):

A. Standard Work Order
B. Open Work Order for miscellaneous maintenance costs
C. Fuel/Oil Issues
D. Maintenance Transaction Correction Sheet
E. Work Unit Code List

The above mentioned forms are completed on a regular basis by the local district and forwarded to a data center, which in this case is the COOR Intermediate Office. There, the data is processed on the computer and returned to the local district for verification. If any errors are detected by the local district transportation supervisor they are corrected and the forms are sent back to COOR. At this point COOR then prints out the final reports, which are returned to the local district.

From the data processed at COOR, four basic management reports are generated. These include the following: Vehicle Operations Summary, Current Month Transaction History, Lifetime Transaction History, and Repair Cycle Index.

Each of the above mentioned reports give detailed summaries of maintenance activity. The cost information is summarized by bus and by fleet for each month of operation with accumulated costs, year-to-date, both by bus and by fleet. At the end of the year these cost totals by category are available to combine with other data to show total transportation costs.

To get a clearer picture of the advantages this system offers,

a more detailed explanation of the management reports will be given.[9]

A. The Vehicle Operation Summary shows fuel/oil consumption, the miles per gallon, the cost of fuel and oil. Figures are computed by bus and by fleet so that the high fuel consumption vehicles may be identified. These same figures are available for the lifetime of the bus to date.

B. The Current Month Transportation History shows all maintenance costs for the month by bus and total costs for the fleet by month. It records every action taken to repair the bus from a simple adjustment to a major overhaul. Each entry shows what was done, the parts used, the date and mileage, when the defect was discovered, what action was taken, and the condition under which the work was done. The latter entry may show that the repair was due to an accident or was done under warrantee. It will also show whether the repair was made in the local district garage, or by a private concern. The dated entry will show how long the bus was out of service. Seperate analysis reports may be prepared from the entry above to meet individual needs.

C. The Lifetime Transaction History contains all maintenance costs for the life of the bus to date. Each local district would have the opportunity to compare repair costs for each bus and determine which units were too costly to keep in the fleet.

[9]The following description of the management reports is from the Project TRI-TRAN Progress report.

D. The Repair Cycle Index is prepared monthly or as needed to analyze the frequency of certain repairs. This index indicates the date and mileage at which a similar repair was made and computes an average repair cycle for the lifetime of the bus. The facts could help the local transportation supervisor plan his preventive maintenance schedule as well as determining the needed parts inventory.

COOR AND MAINTENANCE REPORTING

The need for an intermediate district wide reporting system is clear. The information reports that would be made available will greatly strengthen the management capabilities of the local districts. Not only will the districts be better able to manage their fleet, they will also have information to aid in evaluating present bus specifications and the developing of new ones.

The historical data will easily be adoptable to facilitate the life cycle buying studies and the new versus used bus analysis that were recommended earlier in the report.

The successful implementation of the new payroll accounting system has given COOR the needed experience to coordinate an information reporting system of this nature. Problems that could be anticipated clearly do not lie in the area of data processing expertise. The one thing that has to happen for this system to work is the total committment and cooperation of all the local districts involved. Without this, the system is certain to fail.

It should be clear that the value of this system is increased

when all districts participate. This participation allows more information from similar operations to reach the hands of the transportation supervisor. He will be able to more easily identify problems in his fleet that may be the result of faulty equipment. In many cases it is difficult to prove a breakdown is the fault of the manufacturer and not the fault of the driver or unusual or unique road conditions. With the district wide reporting system, he will have the facts, not mere guesses or hearsay.

It should be noted that this system is very easily adopted by others. It can increase in value if adopted in conjunction with other neighboring intermediate districts and ultimately put in use on a state wide basis coordinated by the State Director of Transportation.

IMPLEMENTATION AND COST

It should be stressed that the maintenance reporting system is a workable program for the COOR District. It can be used by districts who use private shops as well as those who operate their own shops. The point that cannot be stressed enough is committment and cooperation. If the member districts are not willing to work closely with the COOR office in the implementation of this system, its chances of success are minimal.

This system can work if its participants want it to. It is operating with success in five school districts in Hamilton County, Ohio. They are proof that it is operational.

From estimates made by the people from the TRI-TRAN project the cost of implementing and operating this system is about an average of

$2.50 to $3.00 per student. This also includes computer time for other EDP programs that are being used.

To conclude, it must be made clear that it will take at least two years before maintenance reporting by data processing can be made totally operational. Benefits will obviously not be realized immediately, but over a period of years. These benefits are of course contingent upon the use of the data generated. If the transportation supervisors just let the information collect, without using it, the plan will be worthless. However, it is felt that the management tools provided are very easy to use and should be a welcome addition to the transportation supervisors involved.

ADMINISTRATION

INTRODUCTION

The final chapter of this report is directed specifically to the COOR Intermediate Office.

It has been recommended earlier that in the future, COOR should play a vital role in the transportation functions of its member districts. Questions concerning how this role should be performed and who in the intermediate office should perform it have to be answered.

The recommendations to follow will answer the above questions and make clear the need for some centralization of the transportation function.

CENTRALIZATION VERSUS DECENTRALIZATION

The centralization of the entire transportation system from an administrative standpoint is just not feasible. Because of the need for control and coordination at the local level, the role performed by the local transportation supervisor is becoming increasingly important.

The centralization that the study is recommending lies not in the everyday operations but in the general areas of purchasing, routing and maintenance reporting. COOR should not be viewed as a body that replaces the individual district, but as a body that will provide service and assistance. The recommended functions will be centralized in such a manner so as to alleviate much of the tedious work now being performed by the local districts.

PURCHASING

In view of the recommendations made earlier, it is clear that someone in the COOR office will have to be available to coordinate the job of bus body purchasing. He will have to chair the purchasing committee, composed of representatives from the member districts. It will be his responsibility to call the meetings and make sure all points of view are heard. Once agreements are reached on specifications, the COOR representative will be responsible for the total implementation of the recommendations. It will be imperative that he work in close cooperation with all the districts involved.

ROUTING

At this point COOR is only in the infancy stages of routing by computer. An individual is needed who is willing to work closely with the selected district at the July Workshop in Ypsilanti. It will be his responsibility to learn exactly how data processing will apply to the routing situation in COOR.

At this point one can only hypothesize as to what his duties might include if the system is adopted on an intermediate district wide basis. It is clear that he would have to possess a working knowledge of electronic data processing techniques. He would have to be willing to work very closely with the local transportation supervisors, because in the early stages of implementation, bugs can be expected in the system. In the long run, the local districts will probably find that with the input of the proper data, the COOR representative will be able to present them with routes entirely developed by the intermediate office

thus performing a very valuable service for the local districts involved.

MAINTENANCE REPORTING

Again this job will call for an individual with a data processing background. His job in this area will parallel that of the routing function to be performed. He will have to work hand in glove with those at the local level, especially at the outset of implementation. The installation of this system will take a period of orientation and adjustment. It will be the responsibility of the COOR office to make sure everyone involved at the local level completely understands the system. Once this system is operational the work load on the COOR office will be substantially reduced.

PERSONNEL NEEDS FOR THE FUTURE

After considering the present work load of the COOR staff and the expertise that is available at this time, it is recommended that the existing program coordinator with some additional clerical help, should be able to fulfill the above mentioned duties. This may require that he relinquish some of his present duties. The details in this situation can be best worked out by the Intermediate Office.

NEED FOR CONTINUING EDUCATION

It is also recommended that the COOR office should serve the local districts by disseminating new information concerning school bus transportation. It is extremely important that each local district within COOR have complete knowledge of the latest techniques available.

CONCLUSIONS

It is suggested that the previously mentioned recommendations be closely followed by the COOR Intermediate District. All efforts were directed toward the improvement of the present transportation function specifically within the intermediate district as a whole and for each individual member school district.

With this purpose in mind, the following conclusions are evident:

1. The specific areas defined and recommended for centralizing at the Intermediate Office are operationally feasible. This includes the specific data processing applications presented.

2. The full cooperation of both the Intermediate Office and the individual school districts is necessary to administer the suggested recommendations. This can only be accomplished through the careful and progressive program presented by the study.

3. The administrative time and efforts of the local districts can be lessened in this area of school bus transportation by centralizing the previously discussed areas at the Intermediate Office. This would allow the local districts with more time to devote to other dimensions of school administration not as easily provided from the Prudenville Office.

4. More interested intermediate districts such as COOR should be studying the area of school bus transportation in order to provide the most beneficial services for their member school districts.

5. The above study should be specifically investigated by the State of Michigan Department of Education for immediate

research in the Pupil Transportation area. From the informaion uncovered the study definitely finds the State efforts deficient in such cost and time savings accomplishments.

APPENDIX

TABLE I

SUGGESTED COOPERATIVE SCHOOL BUS BODY BID

	BLUEBIRD	CARPENTER	SUPERIOR	THOMAS	WARD	WAYNE
60 Pass. Model No.						
66 Pass. Model No.						
Unit Price (60)						
Unit Price (66)						
GRAND TOTAL						
OPTIONS:						
1. Battery under hood						
2. Saf-T-door						
3. Extra defrosting fan						
4. Right front heater & def.						
5. Rear underseat heater						
6. Aluminum seat back covering						
7. Undercoating						
8. Curved windshield						
9. Vacuum windshield wipers						
10. Tear drop windshield						
11. Fiberglass seats						

Above received Form presently in use by Oakland Schools, Pontiac, Michigan. Note that options are the only specifications explicitly listed. Standard specifications are held constant for all bodies.

EXHIBIT A

DISTRICT NAME

MAINTENANCE WORK ORDER
STATE OF OHIO
DEPARTMENT OF EDUCATION

PROJECT TRI-TRAN

SCHOOL DISTRICT CODE (1-7)	REGISTRATION NO. (8-13)	WORK ORDER NO. (14-18)	BUS NO.	MILEAGE (19-24)	DATE-IN-SHOP (25-30)	DATE COMPLETED (31-36)	HP-32 INSPECTION NO. (37-41)

(42-43)			(44-49)	(50)	(51-54)	(55)	(56)	(57)		(58-61)	(62-67)	(68-69)	(70-72)
QTY.	PART NO.	DESCRIPTION	UNIT PRICE	B/C	WUC	ACT.	COND	WHEN DISC.	DESCRIPTION	LABOR HOURS	CONTRACT COST	MECH. CODE	MECH. RATE

ACTION CODES

A – Adjust
C – Clean
I – Inspect
L – Replace
N – Install – New Equipment
P – Painting
R – Repair
S – Service call
T – Troubleshoot
G – Grease
W – Wax

CONDITION CODE

A – Accident
B – Contract/accident
C – Contract
I – Insurance
W – Warranty
X – Normal Maintenance

WHEN DISCOVERED CODE

D – Driving – not disrupting service
O – Driving – disrupting service
P – Pre-driving inspection
S – PM – Schedule

Source: Project Tri Tran Progress Report

DISTRICT CODE 1-7

EXHIBIT D

CONTROL NUMBER

OHIO DEPARTMENT OF EDUCATION
PROJECT TRI-TRAN

DISTRICT NAME _____

MAINTENANCE TRANSACTION CORRECTIONS

DATE _____

REGISTRATION # 8-13	WORK ORDER # 14-18	MILEAGE 19-24	DATE IN 25-30	DATE OUT 31-36	INSPEC. TION # 37-41	QTY. 42-43	UNIT PRICE 44-49	B /C 50	WORK UNIT CODE 51-54	ACT. Code 55	Cond Code 56	Disc Code 57	LABOR HOURS 58-61	CONTRACT COST 62-67	MECH. # 68-69	MECH. RATE 70-72	CONTROL NUMBER 73-78	FUEL OIL QTY. 25-27	FUEL OIL RATE .000 28-30	GAS OR OIL 31	DATE / / 32-37	Exc. Code 38	CARD CODE 80

MAINTENANCE OPEN WORK ORDER

Minor Repairs

PROJECT TRI-TRAN

District Name:

District Code: (1-7)

Work Order (14-18) 9

REGISTRATION (8-13)	DATE (31-36)	QTY. (42-43)	UNIT PRICE (44-49)	B/C (50)	WUC (51-54)	ACTION (55-57)	LABOR (58-61)	MECHANIC (68-69)

EXHIBIT C

OHIO DEPARTMENT OF EDUCATION

PROJECT TRI-TRAN

VEHICLE SERVICE ORDER

DISTRICT CODE/CONT # (1-7)	REGISTRATION # (8-13)	WORK ORDER # F NO (14-16) DAY (17-18)	DRIVER NAME	CARD CODE 3 4 (80)

GASOLINE					OIL				
MILEAGE (19-24)	FUEL GALLONS&TENTHS (25-27)	FUEL RATE .000 (28-30)	CODE G (31)		OIL IN QUARTS 25-27	COST/QUART 28-30	CODE O (31)	DATE	DRIVER INITIALS

SAMPLE

SAMPLE

WORK UNIT CODE TABLE

CODE	DESCRIPTION
B-0200	Body Sheet Metal
B-0201	Roof
B-0202	Panels - Interior
B-0203	Panels - Exterior
B-0204	Vent Assembly
B-0205	Reflectors
B-0206	Engine Cover
B-0207	Rear Engine Com Door
B-0208	Battery Compartment
B-0209	Seal, Rear Compartment
B-0210	Paint
B-0299	N O C
B-0300	Electrical
B-0301	Bulbs
B-0302	Wiring Harness
B-0303	Circuit Breakers
B-0304	Flasher Motor
B-0305	Sealed Beam
B-0306	Warning Light
B-0307	Marker Light

WORK UNIT CODE TABLE

CODE	DESCRIPTION
B-0601	Motor
B-0602	Arm Shaft Connectors
B-0603	Controls
B-0604	Tubing
B-0605	Washer Assemblies
B-0606	Wiper Blade
B-0699	N O C
B-0700	Defroster Fan
B-0701	Motor
B-0702	Switches
B-0799	N O C
B-0800	Mirrors
B-0801	Brackets
B-0802	Mirror Head Inside
B-0803	Mirror Head Outside
B-0804	Mirror Head Crossover
B-0805	Sunvisor
N-0899	N O C

SAMPLE

SAMPLE

EXHIBIT E